THE SOUTH FERRY & SEASIDE DIRECT TRANSIT COMPANY.

This railway company was chartered last August under what is known as the Tunnel Bill, which was passed in 1880 and became a part of the General Railroad Law of this State, being similar to the Rapid Transit Act, with the exception that it does not require a petition of a certain number of citizens to have a commission appointed to determine whether the road should be built. An application for commissioners is made by the company only in case the consent of the owners of a majority of the valuation of the property along the line cannot be obtained. This company has already obtained more than two-thirds of the required amount of consents, and the remainder is promised on condition that the company give to each owner who signs, full paid stock to the amount for which his property was assessed and which was paid to the Long Island and Jamaica railway companies for closing up the old tunnel and for ceasing operations of their railway on Atlantic avenue, from South Ferry to the city line.*

The line of location proposed by this company is under Atlantic avenue from South Ferry to a point between Third and Fourth avenues; thence between these avenues through purchased private property to the city line and Fort Hamilton; thence probably turning eastwardly and passing through Bath, Sheepshead Bay and over Barren Island to Rockaway inlet, across the latter to Rockaway Beach, making a total distance of about 16½ miles. There will also probably be a branch to Coney Island.

It is the intention of the company to locate its South Ferry depot on the block bounded by Atlantic avenue, Columbia place, State and Hicks streets, giving them a length of 412 ft. of station in the open air. Passing under Hicks street, the railway will communicate with the old tunnel by a curve about 100 ft. east of Hicks street. The company will use the old tunnel from that point to about Court street, where they will have a second station, and from which they will commence their new structure. At some intermediate point between Court street and Third avenue there will be a third station. On Atlantic avenue, between Third and Fourth avenues, there will be a northerly curve to Flatbush avenue, at which point a fourth and central Brooklyn station will be located. This station will also be on private property and open, and will be connected in a direct line to Fort Hamilton. The stations along the remainder of the line to the latter point will be about one-half mile apart.

From the central station to Fort Hamilton the road will be at the same grade below all of the cross streets as on Atlantic avenue, and will be nearly entirely roofed in to Baltic street, at or about which street commences the Gowanus Flatlands, which are not at present filled in. Few of the cross streets are graded until Seventh street is reached. From this street to about Twenty-sixth street will require excavation through a moderately well built-up section. From Baltic street up to this latter point the streets will pass over the road on brick arches or iron beams arched in with brick, the road being open cut when it passes through the blocks.

The remainder of the line to Fort Hamilton intercepts but a few buildings, and from thence to the terminus is of easy surface construction.

The grades over the entire line are light. The track will have a 4 ft. 8½ in. gauge, and will be laid with heavy steel rails.

The formation of the tunnel portion of the line will be in two parallel subways, separated by a brick wall with openings at intervals for communication from one to the other. Each subway will be about 12 ft. wide and 14 ft. high in the clear above the grade of rail. There will be ventilating apertures leading from each side of the tunnel extending to the sidewalks, which will be properly inclosed to prevent trash from getting into them. The movements of the trains will draw in fresh and force out the foul air.

The entire outside surface of the tunnel, top, bottom and sides, will be coated with Lienmer asphalt, so that it will be entirely free from dampness within. The interior will be coated with cement, and the tunnels will be lighted with electricity.

It is the intention of the company, if it uses steam for this portion of the line, to adopt locomotives having the most recent improvements for consuming their own smoke and condensing the escaping steam. The cars will be of a type somewhat similar to those used on the Sixth Avenue Elevated roads in New York City, and the trains will consist of about six cars.

The second and third stations on Atlantic avenue will be of ample length and have platforms of 12 to 14 ft. in width, and the entrances to them will be from both sides of the street.

The surface of Atlantic avenue and the horse-car tracks will remain just the same as they are at present. The sewerage is but little interfered with by the structure, or during construction, as the longitudinal sewers of the avenue are considerably closer to the curbs than the outside walls of the tunnel. The bottom of the Smith street sewer crosses Atlantic avenue about 7½ ft. below the surface of the street, and the tunnel will pass under it, leaving the foundation of the tunnel still from 8 to 9 ft. above mean high water.

There will be but one cross sewer affected between Smith and Third avenue, and that will be depressed under the road and extended with a proper flow to a junction with the original sewer, this being easily done, because the grades of the cross streets fall rapidly towards the south. The entire work connected with the sewers and water-pipes will be made under the direction and to the satisfaction of the Chief Engineer of the Department of Public Works, the company being compelled by the law to meet all the expenses. Water and gas-pipes will be but little interfered with, and never in such a way as to affect a continuous supply.

The cost of construction of the road from South Ferry to Fort Hamilton is estimated to be in the neighborhood of two million dollars. The remainder of the line to Rockaway and Coney Island will cost about the same as the other railways to these points. However, this latter portion of the line is not at present determined on, as the line as far as Bay Ridge is so close to the existent railroads to the seaside that it will be a feeder to them. The close proximity at Third avenue to the Long Island Railroad will furnish traffic to the Brighton Beach, and the same may be said of Gunther's road at Greenwood, as well as Culver's road, which is but a few blocks to the east and directly connected by the street cars. At Bay Ridge the road will run over and above the Manhattan and Sea Beach roads, and will therefore form a close connection with these.

Thus the facilities for Brooklyn to reach the seashore will be materially increased, while the rapid-transit operations of the road from Fort Hamilton to South Ferry, with very frequent trains, is considered by the company to pay handsomely on the capital invested.

The fare at all hours within the city line will be five cents, and to Fort Hamilton an additional five cents, as is now charged by the steam dummies.

The company expects by thus facilitating the traffic to all parts of South Brooklyn, as well as to Prospect Park, to have its revenues continually on the increase, and that Atlantic avenue will reap the full benefit of this trade.

The company expects to get the consents within the next few weeks, and as soon as legal possession can be had of the avenue and the right of way on the remainder of it to the City Line, it will commence work promptly, and intends to complete it within 6 or 8 months thereafter.

It is understood that there are very strong financial men, and having railway experience, in the company, and that there will be no delay in executing the work.*

The officers of the company are Lewis M. Brown, President, at 48 Wall street, New York City; Wm. B. Schermerhorn, Secretary; William Redmond, Treasurer, and Walter J. Morris, Chief Engineer, whose office is at No. 162 Atlantic avenue, Brooklyn.

*The company has now prepared an agreement, which it makes and gives to each owner who has already signed, giving consent, and to each owner who will sign until a majority of assessed value is obtained, securing to them this full paid and unassessable stock.

RAPID TRACK-LAYING IN TEXAS.

HOW TWO MILES OF TRACK PER DIEM WAS LAID ACROSS THE STAKED-PLAINS IN TEXAS, ON THE TEXAS & PACIFIC RAILWAY.

[Written for ENGINEERING NEWS, by W. M. Johnson, Assistant-Engineer in charge of track.]

Statisticians say that there are 94,000 miles of main track and 22,000 miles of second and side tracks now in operation in the United States, and that annually about 300,000,000 people travel over the same.

Yet very few of this multitude know how track is laid on these many miles of railroad, and for their benefit, as well as for those who know somewhat of track-laying, I propose to tell how we laid two miles of track per diem across the staked-plains in Texas, on the Texas & Pacific Railway. Track-laying after a halt of two years was resumed at Ft. Worth on the 25th of March, 1880, and has † now been laid to a point 400 miles west, leaving yet 205 more to reach El Paso on the Rio Grande, which will be finished by Jan. 1, 1882.

The first 100 miles of this was laid in 190 days, at the average rate of 0.526 miles per diem; the second, in 159 days, or 0.629 miles per diem; the third, in 102 days, nearly one mile per day, and the fourth hundred miles in 67 days, or an average of 1½ miles per diem, and this is now increased to two miles per day, which will be maintained until the Rio Grande is reached at El Paso. The delays on the first, second and third divisions (100 miles each) was due to the lack of sufficient rolling-stock to handle the track material as fast as required, but this has now been provided.

Each day at 6 a. m. the superintendent of the track-laying force gives the signal, and the racket begins by the ringing of the engine bell, the two blasts of the steam-whistle, and a clambering and hastening of the men getting on the track-train. Soon after pulling out from the boarding-train for the end of track, the track-train is slowed up to allow different gangs to drop off at the unfinished work of yesterday.

First, the back-fillers, then the liners, then the back-spikers, and at last the tie-loaders jumping off, until at seven o'clock sharp the track-train, followed by the tie-train, is at the front, and all hands begin the day's work.

Standing under a friendly mesquite bush (thermometer 106° in the shade), and keeping one eye out for snakes, scorpions, centipedes and tarantulas, you may observe the course of the work as it passes to the west, and take note of the different features of the system as organized for this contract.

The first individual in the procession is the panel-spacer, with a pick and a 30-ft. wooden pole, who marks on the road-bed each length of 30 ft. (this being the length of the rail used), to guide the tie-wrestlers in dropping 15 ties to each panel.

Next comes the road-maker, with pick and shovel, who moves away obstacles in the way of the tie-wagons, and makes a run-way for them up the sides of high embankments where the haul is too long to reach the end.

Then come the tie-wagons, each hauling 12 oak ties per load, and averaging 10 loads per day, requiring 44 wagons to haul 5,280 ties, or enough for two miles of track per day.

These wagons are driven across the road-bed and unloaded so as to leave 15 ties to each panel of 30 ft. These oak ties are 6 in. thick, 10 in. wide, and 8 ft. long, weighing about 200 lbs. each, making 2,400 lbs. per wagon-load.

Next come the 6 tie-unloaders, who with the teamsters unload the ties upon the road-bed, and following them the 12 tie-spreaders working in 4 gangs of 3 each, one of the 3 with a pick squares the ties across the road-bed, while the other 2 with picks space the ties 2 ft. apart center to center, taking care to place at the end of the panel two selected ties of same size as nearly as possible to come under the rail-joint. Behind these are the 3 tie-liners, who with picks and a ½-in. rope 400 ft. long align the end of the ties on the north (or line side) measuring with a 4-ft. stick from the track centers at each station of 100 ft.

Then the tie-surfacer, with pick and shovel, who lowers all high ties to give an even surface on them for the rail.

These 23 men, with a water-boy, constitute the gang of tie-wrestlers. At a distance generally 1,000 ft. behind the tie-wrestlers follows the iron car, a stout, low, flat car, about 10 ft. long, 7 ft. wide, and 2 ft. high above the rail, with steel rollers on each side at each end and a trough in the middle to hold straps and spikes, upon which is piled a car-load of 44 rails, 5 kegs of spikes and 44 straps, and is dragged forward by a couple of mules driven tandem fashion.

Just in front of this car is the front-gauger, who holds the forward ends of the rails to a gauge as the iron car comes on them, this preventing the track from spreading at that point. Six men run on each side of the iron car, and as it comes to a halt at the end of the last laid rail they run out a bar on each side, and at the word "down" by the heelers they cast the rail upon the ties and launch it back toward the last rail, and the car is immediately run forward another rail length, and this operation repeated until the car has made 22 stoppings and the load of 44 rails is upon the track.

The heelers stop the car at the end of each rail with a wooden chock thrust under the wheels, and each time they throw out a pair of straps, and at the end of every fifth rail a keg of spikes.

The iron car is then speedily run to the rear to be reloaded, the 12 men and the foreman riding upon it, and the mules pushed to a gallop; and this iron car is loaded and unloaded 16 times a day, each car-load of 44 rails laying 660 ft. of track, in all 2 miles.

At each loading of the iron car, about one-half of the straps (22 pair) are thrown into the middle trough, the balance with the 5 kegs of spikes upon the top of the loaded rails.

At each loading 16 men in a line all grasp the rail on the ground, and, raising it up, walk to the side of the car, and at the word "over" by the heeler, throw the rail upon the car, while the foreman, at the rear end, with an iron nipper, and a heeler at the front end arrange the rails side to side upon the pile; it generally requires 10 minutes to load and the same time to unload, and about 15 minutes to run the empty car from the end of track back to the iron pile and back again (loaded) to the end of

*The present capital stock is $1,000,000, fully subscribed.
† Aug. 31, 1881.

track, in all 35 minutes, and this repeated 16 times exhausts the 10 hours work per day.

The rails are laid "square joints," that is, the ends of each pair of rails are opposite to each other and rest upon the same pair of joint ties; for awhile the broken joints were laid where the end of a rail on one side of the track was opposite to the middle of the rail on the other side.

The "suspended joint" is also used where the straps rest at each end on the joint-ties, instead of upon the tie as in the "supported joint."

Besides the front-gauger and a tool-car man and these 12 track-layers, there are 6 men belonging to this gang who unload the rail from the flat cars to the ground, and these 20 men and a water-boy constitute the iron gang.

Close upon the heels of the track-layers come the strappers, 8 in all. Working in couples, one on each side of the track at opposite joints, the first couple untrimming the straps by removing the nuts and locks from the bolts and placing them upon the joint-ties convenient for the other 3 couples, who, coming along, strap the joints by giving the rail the proper expansion distance, and fasten the straps on with the four bolts (nuts and washers on outside of rail).

The 3 couples use expansion bars and strapping wrenches; the first is an octagonal ¾-in. steel bar, 3 ft. long, straight, rounded to a point at one end and flattened at the other like a screw-driver, while the strapping-wrench is a ½-in. round-iron bar with a wrench-socket to fit a 1-in. square nut.

With these 2 tools a strapper manipulates the connecting ends of the rails so as to throw them into proper position and adjusts the straps, securing a snug fit of all the parts and tightens up the nuts. These straps are of rolled iron angle-plates, 2 ft. long; a pair with bolts, nuts and washers weigh 35 lbs., and each mile requires 352 pairs.

Immediately following the strappers is a tie spacer, who with an iron bar throws the 2 joint-ties under the straps so as to bring the slots in the straps convenient for the spikers. After him comes the spike-peddler, distributing 4 spikes on the 1st, 5th, 9th and 13th tie, to be spiked by the front-spikers, a spike on each side of each rail.

Following the spike-peddler are the front-spikers, 4 gangs (2 on each side) of 2 spikers and a nipper, 12 men in all.

Each spiker has a spike-maul, a long-handled hammer something like a ship-carpenter's calking-mallet, the handle 3 ft. long, the hammer 15 in. long, 2 in. in diameter, and weighing 10 lbs.

Each nipper carries a nipping-bar, something like an inch round-iron crow-bar 5 ft. long, and a nipping-block 16½ in. long by 6 in. square, to use as a fulcrum to the lever of the bar in raising the end of the tie, so as to give a solid resistance to the blow of the spike maul.

And the nipping-block is also used by the lead-spikers on the line side to measure the distance between the outside of the rail and the end of the tie to insure a line to the rail on the ties, the gauge keeping the other rail in line.

The front spikers spike the 1st, 5th, 9th and 13th tie in each panel, and these would be every other tie in a half-tied track. The 2 lead-gangs spike the 1st and 9th ties, while the other 2 gangs take the 5th and 13th, each gang skipping 8 ties in moving up. The track is thus spiked at joints, centres and quarters, or what is called "quarter-spiked track." The gangs on the line side keep just ahead of those on the other side, and the track-gauges are carried by the inside men on the south rail. In driving the spikes the outside man, placing his spike close up to the rail, tacks it to the tie by a slight tap. When the inside man gives it the first blow, then the inside man tacks his spike to the tie, and his partner gives it the first blow; then both proceed to drive their respective spike, generally with 5 to 6 well-directed blows, the last blow being so given as to drive the spike-head snug up to the flange of the rail, the nipper in the meanwhile keeping the tie solid against the rail. The spikes are 5½ in. long by $\frac{9}{16}$ of an inch square, weighing ½ lb. each, packed in kegs of 150 lbs., or 300 spikes, and as 4 spikes are used to each tie it requires 10,560 spikes per mile, or 35 kegs, or 1 keg for each 10 rails laid down. Spikes were furnished by the Tredegar Iron Works, of Richmond, Va., and Dilworth, Porter & Co., of Pittsburgh, Pa. These 8 strappers, 12 spikers, spike peddler and tie-spacer, 22 men in all and a water-boy, are called the lead-gang, and are under charge of Mr. John Painter, the superintendent of the track-laying. Closely behind these comes the track-train, pushing to the front another loaded iron car, and it consists of a tool car, 3 dining cars, 8 cars of iron, locomotive and tender, 1 wooden and 2 iron water cars; 8 cars of iron being about 1,000 ft. long and handled by a 10-wheel Pittsburgh locomotive. The tool car is an ordinary low flat car and has 2 large lock-boxes or tool-chests to contain the picks, shovels, bars, mauls and other tools when not in use, and is in charge of a man belonging to the iron-gang, who mends up broken and sharpens dull tools and takes care of them all.

The dining cars are 60 ft. long by 11 ft. wide, and 9 ft. high in the clear, with platforms at each end. Of these dining cars, the 2 on the ends are for the laborers, and will seat 80 men, having a long table and a shelf on one side, giving each man 2 ft. of elbow-room. The middle dining car is in 2 departments, one 40 ft. long for the kitchen, and the other 20 ft. for the foremen, seating the 8 foremen and the 12 trainmen.

In the kitchen a Charter Oak range, No. 835, and a Charter Oak stove, No. 40, are used to cook and bake for 250 men. This department is in charge of a steward, who employs a gang of 15 men, viz.: Two cooks, 1 baker, 7 waiters, 2 scullions, 1 wood-chopper and 2 watermen.

The 16 cars of iron on this train are loaded on flat cars 35 ft. long, each containing 44 rails weighing each 600 lbs., 26,400 in all; 44 straps of 35 lbs. each, 1,540 lbs., and 5 kegs spikes of 150 lbs. each, or 750 lbs.; total load on each car of 28,690 lbs., say 14 tons. The rails being neatly loaded flat, edge to edge, in two tiers of 22 rails each, one ties up-side down between the other, with the straps and spikes thrown on top.

As this track-train is run to the front to push up the loaded iron-car, the 6 men (iron-unloaders) who had been in front helping in loading the iron car, step on the rear of the train and unload a fresh car of iron.

Four of the 6 men remain on the car and throw off first the straps and spikes, and then the rails, one-half on each side of the track, while 2 of the men remain on the ground and straighten out the pile to prevent bending the rail.

The men in throwing iron off the car use crow or pinch-bars, 1-in. round steel bars, 5 ft. long, slightly bent at the lower end to serve as a skid, and care is taken to unload the iron where it can be handled again in reloading on the iron car, avoiding high embankments and narrow rock cuts.

The general custom is to try and unload the rear car first, and the front car last, so that if any car should happen to be still loaded at night, it would be next to the dining cars, and could remain on the track with them at night to make part of the train next day.

If the rail had been loaded on the flats with 50 bars to a load, only 7 cars would be required to each mile of track, but this load with straps and spikes would weigh 30,500 lbs., rather too heavy for the iron car.

The rail used has been furnished by the Cambria Iron Co., Manhattan Iron & Steel Co., and the Allentown Rolling Mills, is 30 ft. long and weighs 60 lbs. per yard, or 600 lbs. per rail, or 100 tons per mile.

The water-tubs with this train consist of 2 iron round and 1 wooden square tank, the iron tanks being 5 ft. in diameter by 24 ft. long and the wooden tank 8 ft. wide, 16 ft. long and 4 ft. high, each capable of containing 3,600 gallons of water or 100 barrels.

The water in the wooden tank is used for drinking and cooking purposes, and is conveyed to the kitchen by a water-wagon.

The water in the iron tanks is used, one for the tie-teams and the other for the locomotive, which requires about 120 bbls. each 24 hours.

This water is supplied from the wells along the line of the road every 20 miles, and is delivered by the water-train of 12 tank-cars to the siding where the material for each days work is made up into trains convenient to the end of the track.

The wells are dug 16 ft. square and 50 ft. deep, supplied with steam pumps and round wooden tubs of 600 bbls. capacity.

THE TIE-TRAIN.

Following within 1,000 ft. of the rear of the track-train is the tie-train of 14 cars, each loaded with 125 ties, weighing 25,000 lbs., and a round iron-tank water-car accompanies this also.

These ties are unloaded 4 or 5 cars at a time, the balance being pushed forward as fast as the movement of the track-train will allow.

Generally, this tie-train is brought out to the point at 7 a. m., another at noon, and a third at 4 p. m., requiring 42 car loads to 2 miles of track.

Sometimes 16 car loads come at 7 a. m., 14 at noon and 12 at 4 p. m.

These oak ties come from the line of the Texas & Pacific Railroad, east of Mineola, and are now hauled 600 miles to the end of track.

To handle these ties, unloading and loading, requires 40 men, working in 10 gangs of 4 each, who, with two-water boys, constitute the "tie-loading gang."

When track was laid through the White Sand Hills sawed heart-pine ties were used, each car-load of 250 ties weighing 32,000 lbs., requiring only twenty-one cars for two miles.

These heart-pine ties, 6 in.×8 in.×8 ft., weighing 125 lbs. each, can be loaded twenty to a wagon, requiring only two men to handle them, and can be distributed, spaced and lined with great ease and facility.

BACK-SPIKERS GANG.

It will be necessary now to leave the shade of the before-mentioned mesquite bush and have the ardent rays of an August sun to see the working of those gangs who bring up the rear and finish up the work left undone by the front gang. And the first gang we meet is the back-spikers, 35 men and a water-boy.

This gang is generally a mile or so behind the tie-train, and as they close up the gap, spiking in full all ties skipped by the front spikers make a regular racket.

This gang is divided into ten gangs of two spikers and a nipper, five gangs on each rail, making twenty spikers and 10 nippers, with two tie-spacers and two spike-pullers and a back-strapper.

A push-car goes with this gang to carry a water-barrel and such loose spikes and bolts as may be left along the track.

The spikes are all driven "staggered," that is, the spikes on the inside of the rails are driven nearest to the west edge of the tie, while the spikes outside of the rails are driven nearest the east edge, thus inside spikes are opposite each other, outside ditto.

The spikes are started and driven perpendicular, close to the rail, and snugly fitting the flange, while care is taken at the joints to spike the slots in the strap.

The tie-spacers square and space the ties again, and the back-strapper tightens up any loose bolts overlooked by the front-strapper.

TRACK-LINING GANG.

About a mile behind the back-spikers come the track-liners—6 men and a water-boy, and a foreman, whose duty it is to align the track accurately to the centers given by the engineer.

These track-centers are pine pegs, with a tack in each, driven at each 100 feet on tangents, and each 50 feet on curves.

With a gauge-stick the foreman places the rail on the line-side in position, several stations at a time, and then with lining-bars his men (three on a side) throw the track either way as he directs, and this is repeated as he goes forward until the line is adjusted.

Some liners, as they put the rail on the line-side in position at each tacked-center, place a small rock or lump of dirt on the ball of the rail to assist their eye in getting the line for several stations at a time, say 10 stations, and keep this up until they are satisfied with the alignment as far as their eye can reach.

BACK-FILLING GANG.

Behind the liners, at a distance of a mile, comes the back-filling gang of 32 men and a water-boy, in charge of a foreman, whose duty it is to cast in dirt from the side-ditches and spoil-banks on to the road-bed, between the ties, to keep the ties apart and prevent them from bunching together, and at the same time to make a kind of water-shed along the center line of the track to drain the rain-water from the road-bed.

A push-car goes with this gang to carry a water-barrel and loose tools, and two of his men are detailed to move the ties that may have been misplaced since spiking, and to see that all are properly squared and spaced.

The surfacing up and ballasting of the track is performed by another contract and is some ways to the rear of the track-laying outfit.

The road-bed is graded transversely level, except on curves, where a cant of ½ in. to each degree of curvature is given to the outside.

THE SIDE-TRACK GANG.

Besides these 7 gangs heretofore enumerated, is a gang of 16 men and a water-boy, called the side-track gang, and in charge of a foreman, whose duty it is to put in the side tracks to be met with every 10 miles, as well as all "Y" tracks, material-tracks, spurs, etc., necessary to a depot yard.

A push-car goes with this gang to transport about the frogs, switch-rails, switch-ties, etc.

The side trakcs are 1,800 ft. long, south side, 15 ft. canters, with Reynolds' patent safety split switch-stand, and a two-story section-house on north side, about half way between head-blocks, and a tool-house adjoining the yard.

These back gangs are brought in to dinner by the return loaded tie-train, and carried out again by same train going for a third load of ties.

THE TIE-HAULERS.

The 44 teamsters who drive the tie-wagons have their dinner brought out to them from camp by a wagon, which on its return carries back a full load of car standards and shattered ties, to be used as fuel.

The teamsters' camp is moved each Sunday to a point 6 miles west of the end of iron, so that the track-laying will pass it again on Wednesday evening, or about the middle of the week.

This camp consists of 3 large boarding tents, each to accommodate 20 men; a tent for the foreman or wagon-master and his corral boss; a

store tent to contain the corn, oats and bran, and 6 smaller tents to sleep 10 men each, as well as a shed for the blacksmith shop.

The force consists of fifty teamsters, a corral boss, a herder, a night watch, a road-maker, the iron-car driver, a blacksmith, a wagon repairer and a veterinary surgeon—58 in all—besides the 3 cooks and their assistants, all in charge of a wagon-master.

The daily feed of the 50 teams is 30 bushels of oats, 20 of corn and a half ton of hay and some wheat bran.

THE BOARDING-TRAIN.

The boarding-train is set out on a spur-track and is moved once a week, and consists of 3 sleepers, a dining-car, a store-car, contractors' car, bookkeepers' car, engineers' car, physicians' car, supply car, trainmens' caboose-car, and in all is about 500 ft. long.

The 3 sleepers and the dining-car are each 66 ft. long from out to out, with boxes 60 ft. long, 11 ft. wide and 9 ft. high.

The sleepers accommodate 70 men each, in double bunks on each side, 3 tier high, the foremen having a compartment to themselves in the end of the front car.

The dining-car is like those on the track-train, and will seat 80 men comfortably, and is for the convenience of any gang left east of the boarding-train, as well as those employed about the boarding-train, and sick men unable to go to the front, and the night crews on the two trains.

The other 7 cars are ordinary box-cars fitted up conveniently for the parties designated above.

The store-car contains groceries and dry-goods, suitable for a community like ours, with clothing, boots, shoes, hats, caps, tobacco, etc.

In here is kept the post-office, as the mail is carried back and forth twice a week between the boarding-train and Colorado City, in Mitchell County, the last established post-office on the line of this railroad.

The physician-car is occupied by the train physician, who has a complete stock of drugs, and is prepared to attend to all persons requiring a physician or a surgeon.

In this car also is domiciled Dr. Montgomery, the honorable U. S. Commissioner, who presides to examine all charges made against parties for violating the U. S. Revenue laws by selling liquor without proper permits, etc.

He is assisted by a U. S. Deputy Marshal.

The supply-car contains commissary stores for the use of the train, such as flour, meat, etc.

The trainmen's caboose-car is occupied by the night crews in the day and by the day crews in the night time.

Near the east end of the train is a tent occupied by the family of one of the men, who wash and iron for all who feel like paying $1.50 per dozen for such a luxury.

The butchers' camp goes generally with the teamsters' camp, and his herd of beef-cattle are kept where water and grass can be found convenient. He kills two beeves per day, and finer and fatter meat was never seen.

The telegraph line is kept up with the boarding-train, the office being in the engineer's car, who sends at night to the chief engineer a daily report of track laid and other work done and number of men and teams employed.

After 6 p. m. the track-train and the tie-train are backed to the boarding-train, where the three dining-cars are left on the main track all night, while the two locomotives, with the empties, go east to the next side-track for the material and water needed for the next day, returning generally about midnight, and sometimes daylight.

This requires a night and day crew on each train, consisting of a conductor, engineer, fireman and two brakemen, and on the night crew a watchman and a wiper. These 23 trainmen are in charge of a master of transportation, who regulates the movements of the trains, and gives all train orders.

The water is brought from the last well to the supply side-track by a water-train in charge of Mr. Killpecker Brown, whose duty it is to keep up the supply of water with the 12 tank-cars at night, and in the day to bring up whatever material he can, and his movements (somewhat eccentric) are supposed to be controlled by the Pacific Railway Improvement Company.

As the contract stipulates that the track-laying contractor shall not haul material beyond 30 miles, the track is inspected and accepted in 30-mile sections by the Texas & Pacific Railway Company, who at once establish a terminal agent and make it a point of delivery.

The fourth division of 100 miles from Fort Worth, which has just been ironed, had on it three tangents, the first 10 miles, the second 42 miles, and the third 47 miles long, joined by 30 minute curves.

The maximum grade was 50 ft. per mile, with only 5 miles of this, the remainder averaging 10 ft. per mile.

The only bridging was a pile bridge 1,600 ft. long and an iron bridge of 100 ft. span over the Pecos River.

So with the road-bed, built through a gently rolling, sandy prairie, with easy grades and comparatively no curves and so little bridging, a remarkably excellent line has been located and a road built, easy to keep up, and admitting of heavy trains and great speed.

In the hot days of June, July and August, the men drank on an average three gallons (one bucketful) of water each, and a gang of 30 men, like the back-fillers, used a barrel of water each morning and evening.

Each water-boy carries two water-buckets for his gang, one of water, and the other of oat-meal and water.

One quart of oatmeal is used to the bucket of water, and having a sweet-milk taste, the men are fond of it, as it also prevents cramp and nausea in hot weather, and a barrel of oatmeal is thus consumed each week.

The coal used on the locomotives is furnished by the Gordon Coal Co., from their mines about 3 miles north of Gordon Station, in Palo Pinto County, 105 miles west of Dallas, Tex.

This coal, delivered at the terminal station, costs $6 per ton, requiring 25 tons per week per engine and 200 tons per month for the two.

The working hours are from 7 to 12 in the forenoon, and from 1 to 6 in the afternoon, 10 hours in all; 50 per cent. extra time is given for Sunday and double time for night work, sometimes necessitated by accidents.

Wages.—The 18 iron-gang men and the spikers get $2.50 per day; the balance get $2; teamsters and train-boys, $1.50. In all the wages aggregate $675 per pay, and the daily expense, including wages, trains, wear and tear of machinery, feed of teams, and loss of tools, etc., is about $800.

The rolling-stock was furnished by the Pacific Railway Improvement Company, but the furniture, bedding, table and kitchen ware, cooking utensils, tools, etc., cost about $10,000, while the 50 teams, wagons and harness cost $20,000, in all $30,000.

Résumé of Force Employed.—23 tie-wrestlers; 20 iron-car men; 22 lead-spikers, etc.; 40 tie-loaders; 35 back-spikers, etc.; 32 surfacers; 6 liners; 16 side-track gang; 58 teamsters, etc.; 15 steward crew; 23 trainmen; 10 water-boys; 10 foremen; 11 others, consisting of general manager, track superintendent, bookkeeper, storekeeper, mail-messenger, surgeon, train-master, watchman, two servants and a water-man; in all 320 men.

To manage this force judiciously and economically required great executive ability, patience, energy and tact, and in this Messrs. Coleman & Co. were greatly assisted by General Manager M. W. Stoll and Track Superintendent John Painter.

The track contractors are Messrs. Michael S. Coleman & Co., the Coleman Brothers, of Madison, New Jersey, of whom Col. M. S. Coleman is now constructing the tunnel under Bergen Hill; Major James Smith Coleman is Street-Cleaning Commissioner of New York City, and Peter Coleman is a railroad contractor in New York State.

THE DRIVING OF THE FIRST TUNNEL THROUGH THE ROCKY MOUNTAINS.

Thursday, Jan. 5, 1882, will for many years to come be a red-letter day in the estimation, not only of the citizens of Helena, but of the people of all parts of Montana Territory; for upon that day the work of driving the tunnel for the Northern Pacific Railroad through the main range of the Rocky Mountains under Mullan Pass was formally inaugurated.

A large number of guests were invited by the contractor, Mr. James Muir, to witness the first operation on the proposed tunnel at Railroad Gulch, about 15 miles from Helena. The engines, boilers and air compressors, which furnish the driving power for the tunnel, are situated at the head of Railroad Gulch, which terminates abruptly against the walls of the summit of the Rocky Mountains. The tunnel enters the mountain at an elevation of about 180 ft. above the machinery plant and is reached by steps cut into the mountain side.

Governor B. F. Potts and Mayor Kissner acted as drillmen, and at 1:30 p. m. the compressed air was turned on and the drills, striking at the rate of 300 times per minute, with a driving force of 750 lbs. to each stroke, began their entrance into the granite walls. Each drill penetrated the solid wall to a depth of 6 ft. within about 20 minutes and the work of driving the tunnel through the range was declared to be fairly commenced.

A dinner, with its accompanying speechmaking, followed. The first toast, "The Territory of Montana," was responded to by Gov. Potts, who, in closing, proposed the following: "To the officials and employés of the Northern Pacific Railroad, from the chief managers of the great enterprise, President Villard and Vice-President Oakes, down to the men who remove sand and gravel."

Col. J. T. Dodge, engineer of the Rocky Mountain Division, responded in a happy speech, of which we give only the first part:

It is very fitting that we should assemble here to-day to celebrate the beginning of one great step in one of the great enterprises of the age. In seeking a route across the Main Range of the Rocky Mountains, we came here to the lowest of all the available passes. We find passes with elevations above the sea level as follows: Deer Lodge Pass, 5,568 ft.; Little Pipestone Pass, 6,455 ft.; Mullan Pass, 5,773 ft.; Dry Cottonwood Pass, 6,807 ft. Ascending from Ten Mile Creek by a grade as steep as the steepest on the Baltimore & Ohio, the great representative steep grade road, we still fall 280 ft. short of attaining this summit. Although the line is developed along these hills to the utmost practical limit, crossing two immense ravines at the height of nearly 90 ft., and making a way through the projecting spurs by heavy rock cutting, still we find ourselves in this narrow valley, shut in by rocky cliffs too high to be surmounted or to be overcome by an open cut. The grade on this line as now run passes 363 ft. below the surface and emerges in a beautiful, broad and fertile basin on the other side. Our only escape from this environment is by a tunnel 3,850 ft. in length, or nearly three-fourths of a mile. It is to be made 16 ft. wide and 20 ft. high to the crown of the arch. The material bids fair to be solid granite, from end to end, and of uniform quality, unless we should happen to find a mine of the precious metals. The material, as you have seen, is to be moved in cars on an iron track, and is to form the large embankment at the eastern end. It is not unlikely that we may meet numerous veins of water, sufficient to form quite a rivulet, as was proved, although it appears so dry and impervious now. But with our modern appliances for blasting, water offers little hindrance to the work.

The able and experienced contractor, Mr. James Muir, to whom the company entrusts the work, expects to advance 5 ft. per day from this end, and to continue work day and night from this time on until its completion.

Two steam boilers and two powerful air compressors will furnish power for operating the great drills with which holes will be sunk 10 ft. deep. The air which transmits the power will, by its liberation, furnish pure air to the workmen. Giant powder, which is the fitting accompaniment of these power drills, will rend these rocks with a force never known until the latter half of this century. Engineers with their lamps and instruments will make their weekly visits to the dark cavern to give the proper points to guide the work as it progresses.—*Exchange.*

THE ATLANTIC AND GULF COAST CANAL.

Among the improvements to which we would call attention as likely to take shape in the year before us, is the construction of canals connecting the lagoons which extend for nearly the entire length of the Florida coast from St. Augustine south. By taking advantage of some creeks and rivers a line of inland navigation for medium draft steamers through these lagoons can be had protected from the ocean by islands or strips of land seaward, for a distance from the St. Johns River of 330 miles, at a trifling cost. What will render the undertaking a promising enterprise is the fact that the Canal Co. have also the right to drain the Okeechobee Lake of some 1,000 square miles area, which lake, now without outlet, in times of freshets backs the water up the various streams which find their only discharge into it, and submerge millions of acres of the richest agricultural soil in the world, with a climate proverbial for its salubrity.

Proper examination has revealed the fact of the easy drainage of this lake by cuts leading to both seas, the ocean on one side, and the Gulf of Mexico on the other—and the construction of the canal will open some 8,000,000 acres to the enterprise of our Northern farmers and to the pleasure travel of a large class of our people who appreciate the delights of a semi-tropical vegetation of wondrous beauty.

The prospectus of the Atlantic and Gulf Coast Canal & Okeechobee Land Company, making all possible allowances for the interested view very naturally taken by proprietors, still leaves a margin of the wonderful advantages of this enterprise, which is worthy of careful study.

The work has been examined and reported upon by James M. Kreamer, C. E., Philadelphia, and the company, of which Wm. S. Stokely is President, have their office at northeast corner of Third and Chestnut streets, Philadelphia. The estimated expense requisite to bring this wonderfully productive soil into market is so small in view of the result to be attained that there can be small doubt of the ultimate success of the undertaking.

ENGINEERING NEWS.

GEO. H. FROST.....PROPRIETOR.

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JULIUS W. ADAMS, *Past President A. S. C. E.*, EDITOR.

S. D. V. BURR..... .....ASSOCIATE EDITOR.

SATURDAY, JAN. 21, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States, Canada and the Sandwich Islands, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

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Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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ANNUAL MEETING OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The twenty-ninth annual meeting of the American Society of Civil Engineers was held at the House of the Society, 127 East Twenty-third street, on Wednesday, the 18th inst. The increasing interest in the Society is shown by the yearly increase of attendance at the annual meeting, and in this respect the present one is most noteworthy. Representatives from nearly every section of the country were in attendance and the interest manifested by all was very gratifying. Vice-President Ashbel Welch occupied the chair, and gentlemen who stand well at the head of the profession filled the rather small meeting-room, and a glance at the gathering would convince any observant person of the truth of the remark made by a gentleman from a foreign country, who, after looking over the party, said: "I have attended meetings of scientific and professional bodies in all parts of the civilized world, but I never saw a gathering of men in whose faces was visible so plainly the intellectuality, force, and that peculiar business-like appearance which make you Americans the most progressive and energetic people on the face of the globe. As representatives of the nation they are a credit to it, and equally so a credit to their profession."

The following is as full a list of members and visitors present as it was possible to obtain: Lyman Bridges, Chief Engineer California Central Railway; Theodore N. Ely, Pennsylvania Railroad; Octave Chanute, Chief Engineer Erie Railroad; Sanford Fleming, ex-Chief Engineer Intercolonial & Canada Pacific Railroad, of Ottawa, Canada, Chancellor of the Queen's University, Kingston, Canada; David Reeves, Phœnix Iron Company, Philadelphia, Pa.; Henry G. Morse, of the Morse Bridge Company, Youngstown, O.; Joseph M. Wilson, engineer of bridges and buildings of the Pennsylvania Railroad; Joseph Waltz, City Engineer of Dayton, O.; Charles Kellogg, of the Kellogg & Maurice Bridge Works, Athens, Pa.; F. C. Prindle, United States Navy; William H. Bradley, Superintendent of Sewer Construction, Boston, Mass.; Martin Coryell, Lambertville, N. J.; Charles G. Darrach, First Assistant Engineer of the Philadelphia Water-Works; Gen. Theodore G. Ellis, Engineer on the Government improvements on the Connecticut River, Hartford, Conn.; William P. Shinn, New York City; William H. Searles, Engineer of the West Shore Road, Newburg, N. Y.; Marshall M. Tidd, Boston, Mass.; Charles E. Fowler, City Engineer, New Haven, Conn., and Albert B. Hill, his first assistant; Gen. William Sooy Smith, Chief Engineer of the Hudson River Tunnel; Capt. Otto E. Michaelis, Ordnance Corps, United States Army; William Metcalf, Crescent Steel Works, Pittsburg, Penna.; Erasmus D. Leavitt, Jr., Chief Engineer Calumet & Hecla mine, Lake Superior, Mechanical Engineer of Lynn & Lawrence (Mass.) Water-works and constructor of the sewerage pumping engines of Boston, Cambridgeport, Mass.; Samuel M. Gray, City Engineer, Providence, R. I.; David M. Greene, Director of the Rensselaer Polytechnic Institute, Troy, N. Y.; Clark Fisher, Trenton, N. J.; Theodore Cooper, New York; L. L. Buck, Central Railroad of New Jersey, New York; Col. W. H. Paine, Francis Collingwood, C. C. Martin and G. W. McNulty, Engineers East River Bridge; Geo. W. Dresser, *American Gas Light Journal*, New York; John Bogart, Secretary of the Society; J. J. R. Croes, Treasurer of the Society; Alfred P. Boller, Chief Engineer Albany & Greenbush Bridge; George H. Frost, ENGINEERING NEWS; Thomas C. Clarke, Phœnixville Bridge Works; George R. Morison, Chief Engineer Bismarck Bridge N. P. R. R.; Henry D. Blunden, First Assistant Engineer Erie Railway; William H. Wiley, of Wiley & Sons, Publishers; Henriques Harris, Engineer Manhattan Beach Railway; Jas. McCrea, Supt. N. Y. Div. Pennsylvania R. R.; Julius W. Adams, Past President A. S. C. E., ENGINEERING NEWS; E. S. Chesbrogh, Consulting Engineer New York City; Thomas M. Cleeman, Philadelphia; Joseph P. Davis, Vice-President and Chief Engineer Metropolitan Telephone Co., New York; Prof. T. Egleston, Columbia College, New York; Charles E. Emery, Engineer New York Steam Heating Co., New York; Bryant Godwin, New York City; Wm. H. Grant, New York City; Wm. E. Hutton, New York; Gabriel Leverich, Brooklyn; Charles Macdonald, President Delaware Bridge Co.; Cook Talcott, Newark, N. J.; Charles D. Ward, Jersey City; W. E. Worthen, New York City; Charles Ward Raymond, Assistant Engineer Hudson River Tunnel; Sebastian Wimmer, New York City.

The report of the Secretary showed an active membership of 655, besides honorary and corresponding members and fellows. During the past year 62 members and 2 fellows were admitted and the losses by death and other causes were 19.

The society has 9,607 volumes, 116 manuscripts, 2,157 maps, charts, etc., 258 models and specimens, its especial feature being the large collection of reports and monographs on railroads and statistics relating thereto. The demands made upon the society for skilled engineers, and the inability to fill these demands were alluded to as an evidence of the growing importance of the profession. The lack of prizes to be offered for competition by writers of engineering essays was regretted, there now being but one prize—the Norman medal—which, by the way, was not awarded, owing to the illness of one of the censors. At a later stage in the meeting an additional annual prize of $50 was created, to be known as the Rowland Prize, in honor of T. F. Rowland, the largest contributor to the building fund. The Treasurer's report showed receipts for the year of $16,834.60, and disbursements, $14,330.81. The fellowship fund aggregates $10,002.75. Receipts for the building fund were $14,012, and disbursements, $10,931.38. It was decided to hold the annual convention in Washington, D. C., next spring, at a date to be fixed upon by the directors. The following officers were elected for the ensuing year: Ashbel Welch, Lambertville, N. J., President; James B. Eads, St. Louis, Mo., and William H. Paine, Brooklyn, N. Y., Vice-Presidents; John Bogart, New York City, Secretary and Librarian; J. James R. Croes, New York City, Treasurer; Thomas C. Keefer, Ottawa, Canada; Col. Thomas L. Casey, Washington, D. C.; Joseph P. Davis, George S. Greene, Jr., and George W. Dresser, New York City, Directors. On taking the chair as President, Mr. Welch returned thanks for the honor, said the fact that applications for membership in the association from all parts of the country, Mexico, Chili, United States of Colombia, British Columbia, Canada, England and India showed that the people of the world were becoming cemented together in bonds of universal brotherhood, and urged upon the society the necessity of such care in the selection of its members as preserves the purity of the bench and the army.

The Committee on Standard Time, by its chairman, Mr. Sanford Fleming, reported, and it proposed that the American Society of Civil Engineers should take the initiative step and invite the governments of the United States, Canada and Mexico to join in a convention to establish standards of time for North America, to which the scientific societies of the countries named shall be invited to send delegates, the governments, societies and scientific men to be invited to send suggestions as to the best plan to be adopted looking toward the end in view. This recommendation was adopted. Gen. Theodore G. Ellis, of Hartford, Connecticut, explained that the United States Government had already in its Signal Service taken steps looking toward the establishment of a standard for this service, and is now having constructed at Waltham, Mass., for this service, a clock made upon the most improved plan, and which is to be finished in February and which will be kept in a room whose temperature will not vary 1° in a year. This is done because the time taken at existing observatories varies a few seconds daily, owing to the fact that their clocks are kept in rooms where the temperature varies from 1° to 10° daily. This absolute standard upon a settled meridian, probably that of Washington, he has been informed, was desired by the post-office and other departments, and any standard fixed upon by such a convention would undoubtedly be most acceptable to them.

Lunch was served in the rooms of the society, after which the subject of testing iron and steel and other building materials was discussed, the outcome of which was the passage of a resolution instructing the Board of Direction to memorialize Congress to appoint a commission to resume the work of investigating into the strength of structures and the materials of which they are composed, with the further recommendation that the commission be composed of practical men, who shall publish the results of their tests, first without comment, for the benefit of experts and people interested in the practical results of the experiments, who may then draw their own deductions. Gen. Sooy Smith advocated most strenuously the establishment of such a commission, to be outside of the War Department, whose members should be paid for their services and appointed by the President.

Mr. Chas. E. Emery exhibited plans and gave an explanation at length of the methods of the New York Steam-Heating Company, after which the meeting adjourned.

According to programme, on the 19th the members met at 10 a. m., at the Manhattan Gas Works, corner of Eighteenth street and Tenth avenue, and after witnessing the operating of the Ross steam stoking machinery, and the "latest thing" in coal chutes, they were taken by the Pennsylvania Railroad steam tug "America" to the Jersey City end of the Hudson River tunnel, where, under the leadership of the chief engineer, W. Sooy Smith, they visited every portion of the works. The party explored the south tunnel only, which is open for about 430 feet to where the air-lock is now fixed. Through the air-lock the more adventurous seekers after underground knowledge proceeded as rapidly as parties of about 25 could be passed; the balance of the party, more hungry for hard-tack, small beer and Roquefort cheese, than experimental tests in compressed air, returned to the tug, whither they were, after a proper interval, followed by the clay-bedaubed contingent that had braved the dirt and danger of the big bore to its very face. These made short shift of the remnants of the "collation" when they once got within reach of the biscuits and beer. The next landing was at the Brooklyn end of the East River bridge, time not allowing a stop at the Pennsylvania Railroad depot grounds, as had been proposed. Up the high circular ladder of over one hundred steps, as on a corkscrew, this crowd of several score men, tall and short, heavy and light, lifted themselves to the roadway of the big bridge, and after halting a moment or so to take breath and a view of the magnificent prospect, the cavalcade proceeded across the bridge on some planks that had been laid down for the purpose. The process of riveting by hydraulic pressure was witnessed, and to the cool-headed ones who could stop without feeling sick at the stomach or light in the head, any amount of information on suspension bridge construction was vouchsafed by the engineers of the bridge who convoyed the party. This is the *first* party, excepting workmen, that has crossed on the roadway of the East River bridge. We "enjoyed" the privilege of crossing on the foot bridge suspended from the towers, in 1878, and having successfully accomplished this later feat in "walking a plank" over a swift-running stream 130 ft. below, are quite content to wait for some more flooring and a railing, before we cross again. The views from the bridge at almost any point on it are unsurpassed by those from any other station in the city or vicinity. Having descended the "corkscrew" at the New York tower, the party proceeded by boat to the Courtland street dock of the Pennsylvania Railroad, and thence, under the intelligent leadership of Mr. Chas. E. Emery, visited the boiler-house of the New York Steam-Heating Company; stood round in the mud, and looked into the street trenches where pipe laying was going on, as well as they could, and then visited the office and looked over the plans. Mr. Emery is engineer for the company, and he took a great deal of interest in explaining and exhibiting everything in connection with his work. After being well surcharged with steam heating, and with feet pretty well soaked by street slush, the party re-embarked and pro-

ceeded to the works of the Dock Department at Twenty-third street. As we didn't go, we do not know what the party thought of what they saw, but we take it for granted that they were well pleased, and especially so when they got a chance to get back to their hotels, where they could "see a man" and warm th ir well-chilled bodies.

The reception and its accompanying dinner, held in the evening, were as eminently enjoyable as such "specialties" in engineering practice usually are. If under the influence of the excellent "exhilarators" always provided by the society's committee, and the charming eloquence of such orators as Messrs. Worthen, Dresser, Fink, Bogart, Cooper, Boller and Andrews, besides others too numerous to mention, a party of fifty gentlemen cannot have a "good time," then such a thing as a "good time" cannot be had. Old acquaintances were renewed, and men whose names are as familiar as household words in the profession, but who were personally unknown to each other, were formally introduced, and every effort was made by the committee to render the occasion as agreeable as possible. There were no toasts and no speeches, the only outbreak in that direction being "A Turnip Story," as related by a distinguished engineer, and which was listened to with bated breath and expectant countenances by all within earshot. The party broke up at midnight. The following is the *menu*, which was furnished by Iauch, of Fifth avenue, near Twenty-third street:

AMERICAN SOCIETY OF CIVIL ENGINEERS.

ANNUAL MEETING,

SUPPER MENU.

Raw Oysters.
Oysters a la poulette.
Fried Oysters.
Chicken Croquettes.
Chicken Salad.
Lobster Salad.
Paté of Game.
Boned Turkey.
Roast Quails.
Salmon—Tartar Sauce.
Sandwiches.
Rolls.
Green Fruits.
Assorted Fancy Cakes.
Ice Cream in Fancy Form.
Meringue Chantilly.
Rum Punch. Coffee.
Claret. Sauterne. Punch.
Champagne.

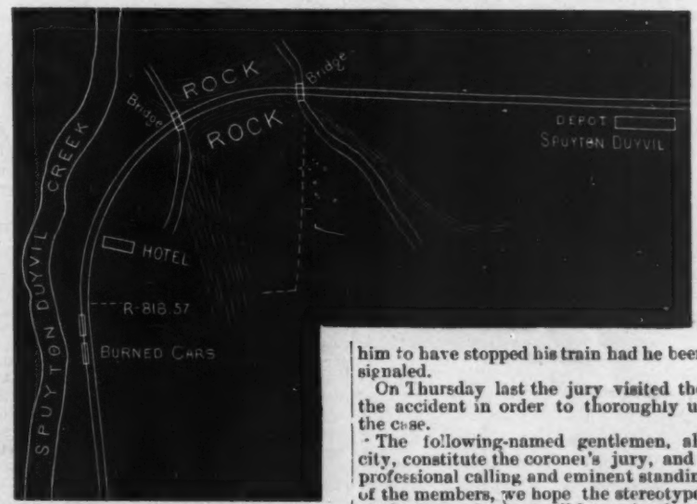
JOHN BOGART,
GEORGE W. DRESSER,
WILLIAM H. PAINE,
C. VANDERVOORT SMITH,
CHARLES E. EMERY,
} Committee.

House of the Society, 127 East 23d st., New York, January 19, 1882.

List of members and guests present: Charles Paine, General Manager, and Walter Katté, Chief Engineer N. Y., Lake Ontario & Western R. R.; Leffert L. Buck, Central R. R. of N. J.; Stephen S. Haight, Topographical Department, N. Y. City; Julius W. Adams, *Past President A. S. C. E.*, ENGINEERING NEWS; Theodore Houston, C. E.; Wm. H. Paine, Asst. Eng. East River Bridge; Chas. G. Darrach, First Asst. Eng. Philadelphia Water Department; Wm. D. Bullock, Asst. City Engineer, Providence, R. I.; Joseph P. Davis, Vice-President and Chief Engineer Metropolitan Telephone Co., N. Y. City; Thomas J. Whitman, Water Commissioner, St. Louis, Mo.; Joseph Waltz, City Engineer, Dayton, O.; C. Vandervoort Smith, Chief Engineer Manhattan Gaslight Co., N. Y.; Samuel M. Gray, City Engineer, Providence, R. I.; Alfred P. Boller, Chief Engineer Albany & Greenbush Bridge Co.; E. D. Leavitt, Jr., Engineer Calumet and Hecla Mine, Lake Superior, and designer of the Pumping Engines Boston Improved Sewerage; Geo. E. Harding, C. E., New York; P. H. Dudley, the "Dynograph" inventor; Charles Macdonald, President and Chief Engineer Delaware Bridge Company; Geo. W. Dresser, Editor *American Gas Light Journal*, New York; Octave Chanute, Chief Engineer Erie Railway; Wm. Sooy Smith, Chief Engineer Hudson River Tunnel; J. T. Sanderson, C. E.; Wm. A. Haven, Engineer in Charge Construction Buffalo Div. N. Y., L. O. & W. R. R.; Cook Talcott, C. E., Newark, N. J.; Robert Escobur, C. E., Delaware Bridge Co.; William E. Worthen, C. E., New York; Ashbel Welch, President A. S. C. E.; E. H. Talbott, *Railway Age;* E. R. Andrews, President Hayford Creosoting Works, New York; Chas. S. Maurice, Bridge Builder, Athens, Pa.; Frances Collingwood, Assistant Engineer East River Bridge; Chas. Kellogg, Bridge Builder, Athens, Pa.; C. C. Waite, Secretary to the President, Erie Railway; Chas. E. Emery, Engineer N. Y. Steam Heating Co.; Chas. Ward Raymond, assistant Engineer Hudson River Tunnel; M. N. Forney, *Railroad Gazette;* Samuel H. Shreve, Chief Engineer Brooklyn Elevated Railroad; Geo. H. Frost, ENGINEERING NEWS; Martin Coryell, Chief Engineer Water-Works, Lambertville, N. J., and brother; Wm. E. Hutton, Consulting Engineer, N. Y. City; E. S. Chesbrough, Consulting Engineer Department Public Works, N. Y. City; Geo. S. Morison, Chief Engineer, Bismarck Bridge, U. P. R. R.; S. Clarence Ellis, Assistant City Surveyor, Boston; Oliver W. Barnes, Chief Engineer Southern Penn. R. R., N. Y. City; Prof. R. M. Thurston, Stevens Institute of Technology, Hoboken, N. J.; C. W. Lewis, C. E.; Lyman Bridges, Chief Engineer California Central R. R., San Francisco; —— Goad, C. E.; Montreal, Can.; D. Van Nostrand, Publisher, N. Y.; Henry D. Blunden, First Assistant Engineer Erie Railway; William H. Allaire, C. E., New York; Jas. C. Aldrich, C. E., North Scituate, R. I.; Wm. H. Wiley, Publisher, New York City; Lieut. Holmes, United States Army, New Brunswick, N. J.; Chas. H. Haswell, C. E., New York City; Thos. C. Clarke, Phœnixville Bridge Works; H. Bissell, Master of Maintenance of Way Eastern Railroad, Salem, Mass.; T. E. Brown, C. E.; Thos. M. Cleeman, C. E., Philadelphia; Sebastian Wimmer, Sr., C. E., New York City; Sebastian Wimmer, Jr., New York City; Wm. H. Bradley, Superintendent of Sewers, Boston, Mass.; Sanford Fleming, ex-Chief Engineer Dominion Government & Canada Pacific Railway, Ottawa, Can.; William Metcalf, Crescent Steel Works, Pittsburgh, Penna.; Albert B. Hill, Assistant City Engineer, New Haven, Conn.; Prof. William Watson, Boston, Mass.; Prof. H. S. Monroe, Columbia College, New York; A. R. Haddock, W. Kingsford, Ottawa, Can. Mr. Maclin, England; George S. Baxter, New York City; Albert Fink, Past President American Society Civil Engineers, Commissioner of Pool Railroads; Geo. S. Greene, Jr., Chief Engineer Dept. of Docks, New York City; Mr. Seward, F. O. Norton, New York City; Theodore Cooper; Civil Engineer, New York City; Jno. Bogart, Secretary American Society Civil Engineers; Wm. P. Shinn, Civil Engineer, New York; James McCrea, Supt. N. Y. Div. Pennsylvania R. R.; Richard Schermerhorn, Chief Engineer and Supt. B. B. & Coney Island R. R.; Clark Fisher, Trenton, N. J.; Bryant Godwin, Civil Engineer.

THE SPUYTEN DUYVIL ACCIDENT.

On the evening of the 13th, an accident occurred at Spuyten Duyvil on the New York Central and Hudson River Railroad, which resulted in the death of 8 persons and the serious injury of many others.



The train known as the Atlantic express leaves Albany at 2:40 p. m., and on account of its speed and convenient time of starting, is a favorite train with people traveling toward New York. The Legislature, when in session, usually adjourns in time to permit those of its members who so desire to take this train to the city, and on the present occasion it was well filled with legislators and representatives of the press. The train consisted of thirteen cars, the last six of which were drawing-room cars. It was about thirty-five minutes late when it left Albany, and it had nearly made up lost time when—for some reason as yet unknown—it came to a halt on the end of the first curve after passing Spuyten Duyvil station.

A local train from Tarrytown waited until 6:40 p. m., when the express went by and the local followed. According to the statement of the engineer of the local he stopped at Spuyten Duyvil at 7:14, and according to the time-board was then thirteen minutes behind the express. Soon after leaving the station—the position of the trains will be readily understood by consulting the accompanying drawing—he entered a cut at the commencement of a sharp curve and which was just wide enough to permit of two tracks and where the walls were jagged and perpendicular. This cut extends about one-half the distance of the curve, and after leaving it the view of the track beyond the tangent point is completely and effectually hid by a building, situated as shown on the drawing. The Tarrytown special swept around this curve and did not see the express until within 150 or 200 feet of it. A terrific crash followed, the rear palace car being telescoped on to the next one and both set on fire. Owing to the rapidity with which the flames spread nothing could be done toward rescuing the passengers who were imprisoned by the timbers of the rear car. The palace cars were made by the Wagner company, and in the rear car was State Senator Webster Wagner of that company.

The cause of the accident seems to rest with the rear brakeman, who, according to the rules of the company, should have gone back half a mile to signal the local. The engineer of the local testified before the coroner that when he first saw the flagman he (the engineer) was not more than 350 feet from the end of the cut, his view being obstructed by the smoke-stack, bell and sand-box of his engine. Had the brakeman gone back about 700 feet, he would have reached the cut between the rocks, through which a track-walker passes after each train in order to see that no obstructions have fallen upon the track. From there he could have signaled the track-walker, even if he had been at the other end of the cut, and thus prevented the accident. Had he gone back the required half-mile, he would have passed through the cut. Owing to the positions of the hotel and the standing train, it was impossible for the engineer of the local to see the rear lights while at a distance sufficient to avoid a collision.

Last Monday one of our reporters visited the scene of the accident, and judging from the burnt ties of the position of the last car (see the sketch) it would have been impossible for the approaching train to have seen the brakeman in time to stop if the brakeman was only thirty or forty feet in the rear of his train. As before stated, the position of the hotel is such as to hide the straight stretch until the approaching train has nearly rounded the curve.

The engineer stated to the jury that he was going at the rate of 18 or 20 miles an hour, and that the distance from the end of the cut to rear car of the express (700 ft.) would have been sufficient for him to have stopped his train had he been properly signaled.

On Thursday last the jury visited the scene of the accident in order to thoroughly understand the case.

The following-named gentlemen, all of this city, constitute the coroner's jury, and from the professional calling and eminent standing of some of the members, we hope the stereotyped form of verdict in such cases will be omitted and the real cause of the accident ascertained:

Egbert L. Vielé, civil engineer; Henry J. Davison, civil engineer; Edward Haeuser, restaurant keeper; William H. Weightman, engineer; Henry Eichling, mechanical draughtsman; Leander T. Howes, banker; L. E. Schmieder, dry goods; Charles H. Haswell, civil engineer; David H. McAlpine, tobacco manufacturer; Francis J. Burke, real estate; John Peyser, saddlery, and Isaac Teichman, cigars.

NEW YORK STATE REPORT PUBLIC WORKS.

We make space for extracts from the report of the State Superintendent of Public Works, S. B. Dutcher, as calling attention to matters of grave import in the bearing of the policy pursued in reference to our State canals upon the commercial prosperity of the city of New York, and incidentally to the material interests of the State at large.

The report is clear and emphatic, and merits the careful consideration of our legislators. Some of the facts which it presents do not make pleasant reading, but the Superintendent has done his duty faithfully in presenting them in their naked aspect without gloss or varnish of any kind. The tolls have fallen off, the tonnage has decreased, the season has been unpropitious to the boatmen, and the very maintenance of the canals imperilled

by the constitutional amendment limiting the annual expenditures. The time is approaching when the question must be looked squarely in the face, whether the commercial supremacy of the city of New York does not call for the abolition of all tolls on the canals, and the expenditures necessary to maintain them in their efficiency be made a tax on the people of the State, or borne by some interests which may properly be made to contribute to that end.

Expenditures on canals for fiscal year ending Sept. 30, 1881:

Ordinary repairs and operating expenses	$897,324.36
Extraordinary repairs	85,864.93
Total	$983,189.29

As stated in the report of last year, the structures of the canals, especially the locks and bridges, had not received the attention during the past few years that was necessary to keep them in proper condition.

The expenditure in rebuilding, repairing and improving this class of structure alone was the sum of $68,180.18.

* * * * *

Work, estimated to cost about $800,000, recommended by the Engineer Department as necessary to put the canals in good order, and restore them to their original condition as when first enlarged, has not been done because of want of funds and time.

* * * * *

The tolls and tonnage during the past seven seasons of navigation have been as follows:

	1875.	1876.	1877.	1878.
Tolls	$1,590,032	$1,340,004	$880,896	$993,348
Tonnage	4,859,958	4,172,129	4,955,963	5,171,320
	1879.	1880.	1881.	
Tolls	$941,574	$1,155,419	$632,380	
Tonnage	5,302,372	6,457,656	5,175,505	

The tolls for the season, as compared with that of 1880, have fallen off over 45 per cent., while the decrease in tonnage is only 20 per cent. This large decrease in receipts does not verify the predictions expressed to the Legislature and the Canal Board by the advocates of lower tolls when the same were under consideration by those bodies.

The average tonnage for the previous six years, 1875 to 1880, inclusive, was 5,168,233 tons; for 18 1, 5,175,505 tons, showing the tonnage greater for the latter season than the average for the previous six years. The decrease in revenue is due in part to the abolition of tolls on west-bound freight, but in much larger measure to the lessened shipments of through cargoes of grain from Buffalo to the seaboard; more than three-fourths of the decrease is justly chargeable to the latter cause. The shipments of grain and breadstuffs from Buffalo in 18-0, were 71.909.904 bushels; in 1881, 31,151.761 bushels; the tolls on these shipments in 1880, were $700,199, in 1881, $290,444. The decrease in east-bound freight tonnage is owing to a lessened export demand; a smaller surplus of agricultural produce in the West, and the competition of the railroads, which has been unparalleled.

The season has been a most disatrous one to boatmen.

The freights on east-bound merchandise have averaged lower this season than ever before in the history of the canals.

* * * * *

The following table shows the receipts and exports at the five principal ports in our own country and the one principal port of Canada, from January 1 to November 30, in the years 1880 and 1881, and confirms the statement, before made, that the decreased tonnage by canal is in large measure due to the lessened demand for our products abroad.

RECEIPTS.

Ports.	1880. Bushels.	1881. Bushels.		
New York	161,127,892	135,601,594	Dec. 16	per ct.
Baltimore	53,850,524	41,451,562	Dec. 23	"
Philadelphia	45.276,697	27,502,605	Dec. 39	"
Boston	31,762,548	34,351,780	Inc. 7	"
New Orleans	21,100,039	18,855,180	Dec. 10¼	"
Montreal	23,628,012	19,984,165	Dec. 15	"

EXPORTS.

Ports.	1880. Bushels.	1881. Bushels.		
New York	122,597,913	90,571,083	Dec. 26	per ct.
Baltimore	45,146,811	33,775,675	Dec. 25	"
Philadelphia	30,470,733	18,153,103	Dec. 40	"
Boston	18,760,267	16,142,150	Dec. 14	"
New Orleans	14,860,111	12,483,736	Dec. 16	"
Montreal	25,846,310	17,598,133	Dec. 32	"

CONSTITUTIONAL AMENDMENTS.

The revenues during the fiscal year, which the expenditures for collection, superintendence and repairs for the fiscal year ending Sept. 30, 1882, cannot exceed, were $818,264,61.

Expenditures eqnal to those receipts will, unless there is some great disaster, secure good navigation during the remainder of the year; but if the receipts for the balance of the present fiscal year, from the opening of navigation to Aug. 31, are not larger in proportion than for the portion which has elapsed, from Sept. 1 to close of navigation, the maintenance of the canals will be periled the following year.

The lessened export demand and less surplus products in the West, coupled with the greater facilities by the St. Lawrence and Mi ssippi routes, furnish no reason to expect larger receipts during the spring and summer of 1882 than during the same period in 1881, and justify the assumption that the revenues for the fiscal year ending Sept. 30, 1882, will not exceed the revenues of the calendar year 1881, or about $632,000, an amount less than the expenses of collection, superintendence and repairs during any year since the enlargement.

The improvements on the Mississippi River and the enlargement of the Canada canals, affording increased facilities and lessening the cost of transportation by those routes, make it absolutely essential that the cost of transportation shall be lessened from the lakes to the seaboard, if New York is to maintain her commercial supremacy.

The facilities afforded by the canals for many years over any other route added much to the resources of our State, brought vast amounts of capital to our commercial centers, added largely to the volume of taxable property in those centers, and thus reduced the burden of taxation in other portions of the State.

The tolls during the past season of navigation have been about 20 per cent. of the cost of transportation on through cargoes to tide-water. Freeing transportation from this tax will undoubtedly add much to the volume of business, make available the large investment in boats and canal equipment, bring additional capital to our large cities, and again cause large additions to the volume of taxable property in those cities. Making the canals free will benefit the State if future Legislatures are prudent in making appropriations and those in charge of the canals are economical in their expenditures. Lavish appropriations and unnecessary expenditures would soon produce a feeling of indignation that would prompt the people to abandon these highways of commerce.

The State can well afford to maintain them if prudently managed as a regulator of freight rates. The terminal and all port expenses should be made as moderate as possible, thus relieving our commerce of every unnecessary tax and charge.

From the completion of the canals to the present time, the tendencies of many of the cities and villages through which they pass has been to construct and maintain their sewers so as to empty the same into the canals.

This is not surprising, as, passing through the central portions of the cities, they furnish an easy and inexpensive mode of drainage.

To such an extent has this practice prevailed that it has at last not only become a great public nuisance, but a heavy burden upon our already over-taxed canal revenues. The canals are not only used as an outlet for sewage matter, but are regarded by the adjacent owners as a common receptacle for all the garbage and débris from the streets. The health of the people is a matter of such importance that it should receive our first consideration. The present condition of the Erie canal cannot be regarded in any other light than as a channel for the distribution of disease and pestilence the entire length of the State, and especially so on the western division.

For this condition of things the people residing in its immediate vicinity are alone responsible. The cases of Buffalo and Lockport need only be cited to confirm this charge, and illustrate the importance of enacting such statutes and inaugurating such measures as will relieve the citizens residing in those cities, or adjoining the Erie canal between the same, and those engaged in its navigation, from this health and life-destroying nuisance.

A large portion of the sewage of the city of Buffalo, conveying the offal and refuse from many of their slaughter-houses and distilleries, is emptied into the Main and Hamburgh canal, and is thus conveyed to the Erie canal, where, mingling with its waters, it is moved forward, and its baneful effects are visible nearly or quite as far eastward as Rochester. For many miles the stench during the heated term is almost unbearable, and results in sickness and death not only of those engaged in navigating the canal, but to those residing adjacent thereto, to an alarming extent. Men not only invest their money in the necessary equipment of the canals, but the boatmen take their wives and children on their boats—the boat is their home—the home of many of them during the whole year. The State should protect them against such unnecessary exposure to disease and death.

The complaints from Lockport to this department during the past season have been frequent, and petitions for relief to its citizens from the Buffalo sewage have been strongly urged by those having the health and prosperity of their people at heart. Yet in the face of these complaints, and at the same time, nearly the entire sewage of the upper town of Lockport was discharged into the Erie canal, and no efforts were being made by the proper authorities to find other channels for the same. An engineer of large experience estimates that more than 200,000 cubic yards of the sediment deposited along the bottom of the canal on the western division is chargeable to this cause alone, of which more than three-fourths is justly chargeable to the Buffalo sewers and manufactories.

From these evils the present statutes afford no relief, and the subject is presented as one imperatively demanding immediate legislation. Cities and villages along the line should be required to find other outlets for their sewers, and individuals and corporations prohibited from making the canals a repository for refuse or débris of any description.

In the case of the city of Buffalo, the State, by the construction of the canal, cut off the natural drainage of the city to the lake, and unless some relief is afforded by the State a heavy burden is cast upon the city in her efforts toward sanitation, and the true policy of the State should be to endeavor foster to this effort rather than to cripple it.

THE IRON TRADE.

[Prepared specially for ENGINEERING NEWS.]

It may be too soon to inquire into the probability of the completion of all the numerous enterprises on the carpet for the current year. Far seeing investors are discounting all kinds of possibilities and probabilities. Some of them are entitled to consideration. Some are not. The value of railroads and railroad stocks are made to depend largely on the volume of our export trade, while that in turn depends on, mainly, the condition of foreign crops, the necessities of foreign consumers and their ability to purchase. There is a commercial battle in progress between the leading nations. American supremacy as a cotton producer is conceded, but the supremacy in wheat will not be conceded without a vigorous effort to organize agricultural activity in Britain's colonial dependencies, which may possibly liberate that country from too great dependence on our markets for breadstuff supplies. The connection between these considerations and the prosperity of engineering enterprises is, in brief, this: If it pays to keep on building railroads, engineering talent will find corresponding activity; if not, only moderate activity will characterize engineering operations. Within a few days practical steps have been taken looking to the organization of ship-building enterprise. It is apparently anticipated that the powerful political, commercial and manufacturing influence, now about organized for action before Congress, will result in positive and satisfactory action on the part of the Government. In fact, the feeling on the necessity of a merchant marine and lines of vessels with foreign ports is no longer confined to a few presumably interested parties, but is participated in by all classes, even to farming interests, who therein recognize that such aids are essential as links in the chain which connects their barns and granaries with foreign consumers. In fact, the feeling on the subject of lines of ocean steamships is akin to that which made a protective tariff in 1861 a welcome expedient to many who otherwise had theoretical objections to it. An export trade is now demanded by farming and manufacturing interests as well as commercial interests, and when such interests harmonize there are probabilities of practical results. The importance of this movement and the strength of it is observed by closely observing people abroad, and enterprise is warned to be on the alert for such possible victories and inroads on British supremacy on the high seas as were secured in the domain of manufactures, through the primary agency of the Morrill Tariff of 1861. The activity already displayed in ship building in the coast-line and harbor service is an indication of the vitality which changing circumstances and conditions is infusing into the shipping interests so long neglected. The Cramps at Philadelphia have inquiries relative to their probable facilities for executing contracts next spring and summer. The same, in fact, is true of some of the lesser concerns on the Delaware and elsewhere. The necessities of commerce are forcing a revival of ship building. The builders of marine engines and the manufacturers of iron and steel for use in ship building are busily engaged with urgent orders for work of this character. Enterprise in this direction is not being repressed by any inflation of prices in raw material. That a revival in ship building is near at hand none can doubt who take occasion to observe the course of events. Congress is evidently disposed to do the bidding of those most highly interested. Definite plans have been prepared, but not all friends of more ships are in accord. The improvement of our shipping interests opens a wide door for engineering enterprise and capital, which will be entered promptly.

Already the demand for iron and steel is being felt in the chief centers. Prices are very firm. Steel is especially in active demand, and lower grades have been advanced. The larger works are expanding their capacity. The magnitude of the probable demand has not been estimated. The

activity at Sheffield and other foreign steel centers prevents any vigorous competition; but there is no disposition to take all the market will bear, as it is said railroads are sometimes disposed to do. Such a course would be productive of several evident evils, among which are competition of new firms and fluctuating prices. The blast-furnace industry has a heavy responsibility to face in maintaining supplies for the extraordinary consumption, which certainly will not grow less. The rolling-mill interests are overrun with orders and are unable to accept all. Foreign markets are firm and hence imports are very light. Manufacturers checked the advancing tendency by declining to make an advance; a policy which has demonstrated commendable foresight. Meetings are to be held in the East and West on Monday next to take a view of the iron situation, and in view of a probable advance, declared formerly by a resolution, or effected by active demand, manufacturers have endeavored to avoid long or heavy engagements. Nails have been advanced by the action of makers at Pittsburgh, Harrisburgh, New York and Boston. Extraordinary activity in building operations is anticipated, and makers are running to fullest capacity to meet the requirements of the spring trade promptly when it comes.

PERSONAL.

MR. JOSEPH E. WALTZ, City Civil Engineer of Dayton, O., was in the city this week to attend a meeting of the Alumni of the R. P. I. He was also a guest of the Amer. Soc. of C. E. at its excursions and reception on Wednesday and Thursday.

MR. THEODORE COOPER, Mem. A. S. C. E., of 35 Broadway, is rebuilding the cement works of F. O. Norton, Esq., at Binnewater, near Rondout, N. Y. The old works were recently destroyed by fire, and Mr. Norton now intends to remodel the plant and increasing its capacity.

MOSES LANE, City Engineer of Milwaukee, Wis., and one of the best known hydraulic engineers in America, has been so prostrated by a stroke of paralysis that his life is despaired of. The many friends of the afflicted engineer will be pleased if more favorable news is received next week.

MR. PURCELL, Division Engineer on the Georgia Pacific Railroad, was seriously injured by the fall of a construction train through an undermined trestle about 8 miles from Columbus, Miss., on Sunday last.

GEO. WM. BALLOU has been elected Vice-President of the Mutual Union Telegraph Company.

SIDNEY T. FULLER, Mem. A. S. C. E., ex-Chief Engineer of the Philadelphia, Wilmington & Baltimore Railroad, has been appointed General Superintendent and Chief Engineer of the North Division of the Mexican National Construction Company and the Mexican National Railroad Company; also, General Superintendent and Chief Engineer of the Texas & Mexican Railroad. His duties as General Superintendent and Chief Engineer extend over all the lines of these companies north of San Luis Potosi, and also will include the Matamoras Division.

THOMAS J. WHITMAN, water commissioner of St. Louis, Mo., and who was at the annual meeting of the A. S. C. E. this week, had a strange experience recently. He accidentally swallowed a common wooden tooth-pick; pains were felt some time afterward in his back, and a few days ago the intrusive cause of them was cut out of his back just above the hip.

GENERAL SIR WILLIAM ERSKINE BAKER, R. E., K. C. B., died on the 17th inst., at his residence, the Castle, Banwell, near Weston-super-Mare, England, at the age of 73. The deceased held successively in India the appointments of Superintendent of the Delhi Canals, Superintendent of Forests and Canals in Sindh, Director of the Ganges Canal, Consulting Engineer to the Government of India for Railways, and Secretary to the Government of India for Public Works.

DR. CARL CULMANN, the eminent engineer, died at Zürich on Dec. 9. The deceased was born in 1821, at Bergzabern, in the Bavarian Palatinate. He was best known as a railway engineer, and designed many bridges both for German and Swiss railways, and other important works. He made Switzerland his permanent home when, on the foundation of the Polytechnic School of Zürich, he accepted an appointment on the teaching staff as professor, which he held for twenty-five years. He was the author of "Die graphische Statik," and was just on the point of completing a second edition of this work when death overtook him. He contracted a disease on a professional trip to Constantinople, which proved mortal; but he was able to reach his adopted home, were he breathed his last.

R. P. I. ALUMNI.

That the engineering profession is not completely engrossed in the dry calculations of strains and stresses, sectional forms, or the removal of heavy materials, may be inferred from the reports of the past two weeks of the several assemblages of the profession held throughout the country. Of the strictly social events, the second annual reunion of the Alumni of the Rensselaer Polytechnic Institute, held at the Hoffman House, this city, on Tuesday evening of this week, must take precedence. The deep interest in their Alma Mater expressed by certain of its alumni led to an initiative reunion last year, when the Hon. Clarkson N. Potter opened his hospitable mansion for the occasion, the pleasant results of which were duly chronicled in this journal. The eminent success of that event may be said to have insured the success of the future, and the alumni meeting of the R. P. I. may now well be considered as a "regular thing" for each ensuing season.

At the meeting on Tuesday evening, Mr. B. F. Greene, an old-time Director of the Institute, and now a retired officer of the U. S. Navy, presided, and about one hundred gentlemen, mostly all prominent members of the profession, assisted in doing justice to the *menu* provided in the usual excellent style of mine host of the Hoffman. The first regular toast of "Our Alma Mater," was responded to in some pleasant reminiscences by President Greene, which were supplemented by a timely letter in the same line from W. W. Evans; by the exhibition of an autograph letter from the old Patroon, Gen. Van Rensselaer, the founder of the Institute, and by the reminiscences of Messrs. Le Grand B. Cannon and Profr. E. N. Horsford, who thumbed the text-books of the school some half a century ago.

The second toast, "What the Rensselaer Institute has accomplished and what we owe to it," was responded to by Mr. Strickland Kneass, Vice-President of the Pennsylvania Central Railroad.

"Technical Education; what is it?" was answered by President Henry Morton, of the Stevens Institute.

"The Press" was responded to by Mr. Jo Howard, Jr., and "Engineering and the Law," in the absence of the person selected to respond, was answered by Mr. A. P. Boller. "The American Society of Civil Engineers" was responded to by Mr. John Bogart; "The Institute of Mining" and "Our Sweethearts and Wives," by Dr. R. W. Raymond, and "The Descriptive Geometry of Steel," by William Metcalf.

The committee on entertainment were Messrs. Chas. Macdonald, Pres. of the Delaware Bridge Co.; J. M. Wilson, Philadelphia; Joseph P. Davis, Vice-Pres. of the Metropolitan Telephone Co., and Prof. H. B. Nason, who certainly deserve much credit for the able manner in which their duties were discharged.

The bill of fare was a work of art, giving vignettes of student life, such as the students passing the young ladies from the seminary with the words "eyes left," "Botanizing," "Castleton," where annual surveys of diverse kinds are made; a fine view of the Institute buildings, of the East River Bridge, of running a transit line, etc.

The following is the *menu*:

MENU.

HUITRES—Blue Point.
R-oysterers, welcome!

POTAGES. *Amontillado.*
A sop for Cerberus, or any other man.

Bisque d'Ecrevisse à la St. Gervais.
Printanier Dorsey.

Variés. HORS D'ŒUVRES. Variés.
Bouchées à la Reine.

POISSON.
Be careful, this Pois(s)on may give you a—Sauterne.
Saumon, sauce Génevoise.

ENTREE. *Pontet Canet.*
Now bind the filet on her brow—(poetical license or strain.)
Filet de Bœuf piqué Providence.
Poularde braisée à la Vénitienne.
Galantine de Faisan en Bellevue.

ENTREMETS.
Some spell it salary.
Petits Pois. Pommes, Duchesse.
Haricots Verts.
Céleri braisé au Jus.
SORBET AU KIRSCH.
Cigarettes de Kimball.

ROTI. *Chambertin.*
The student by a maid was struck;
He fairly quail-ed before the duck.
Quails. Mallard Ducks.
Salade de Laitue.

ENTREMETS SUCRE.
Mumm, Dry Verzenay.
Charlotte, keep mumm.
—Old Play.
Charlotte à la Russe. Gelée Rubanée.
Glacé.
Corbeille Jardinière.
Corne d'Abondance. Sultane Parisienne.
Gateaux assortis. Petits Fours.
Fromage.
Fruits.
Café.
Cognac. *Cigars.*

It was after midnight when the last guest departed, and we doubt not that these reunions will have a good effect in firing the ever-youthful hearts of the graduates of the Institute with enthusiasm for their dear old, and somewhat moss-covered Alma Mater.

ENGINEERS' SOCIETIES.

A FLOURISHING SOCIETY OF ENGINEERS.

The Society of Engineers of Western Pennsylvania on the 16th elected the following officers for the ensuing year: President, A. Gottlieb; Vice-President, William Thaw, Jr.; Directors, A. Demipster and M.V. Smith; Treasurer, A. E. Frost; Secretary, J. H. Harlow. The society has 250 members, plenty of money in the treasury and an interesting library.

ENGINEERS' CLUB OF PHILADELPHIA.

ROOMS, NO. 1523 CHESTNUT STREET, PHILADELPHIA, PA.

Record of Regular Meeting, Dec. 17, 1881.

Vice-President Henry G. Morris in the chair. Twenty-six members and two visitors present.

Mr. T. M. Cleemann exhibited photographs of and described several examples of ancient Roman masonry. He regarded as the most important and remarkable, for its excellent preservation, the aqueduct at Nismes, in the south of France, which was built at about the beginning of the Christian era, and represents the engineering skill of the Romans when their power was at its height. It consists of three tiers of arches, the two lower being similar and superposed on one another, the upper tier of much smaller dimensions, upon the top of which runs the water channel. The various arches differ in span—lacking the regularity and conformity to one pattern of modern works. The center line was likewise not perfectly true, showing that no transit had been used by the Engineer in Charge.

The approximate dimensions are as follows: Largest arch, span 75 ft., piers 15 ft. (by Rankin's rule about 11½ ft.); ring stones, 4 ft. thick (Rankin, 2½ ft.); water channel, originally 6 ft. × 4 ft., rectangular, now reduced by calcareous deposit nearly 1 ft. thick. Bond of piers, alternate header and stretcher, in courses of about 18 in.

In the lower tier the arch-stones are laid in four, and in the middle tier in three rings, without bond; in the upper tier in two rings, breaking joint. Closely laid rings, without bond, were also observed in a Roman bridge at Avignon.

Numerous stones projecting from intrados and face are supposed to have been left to support centers and scaffolding during construction. The whole structure seems to be founded on rock.

An aqueduct near Rome and the Basilica of Constantine were also described. The latter was built about A. D. 300, and consists of bold arches, 66 ft. span, of brick, one abutment of which is only about one-third of the radius of the arch, which is considerably thinner than Rankin's rule would require, but the use of old Roman cement has reduced the structure to almost a monolith.

Mr. Thomas C. McCollum contributed a block, cut from a pile which had been under water but three months near Pensacola, Fla., and, not having been creosoted, was completely honeycombed.

Prof. L. M. Haupt read a letter from Mr. Walter Shanly, C. E., upon the water transportation routes from the Northwest to Europe.

Several communications from members of the club were read.

HOWARD MURPHY,
Secretary and Treasurer.

The fourth annual meeting of the Engineers' Club of Philadelphia was held on Jan. 14 at their new rooms No. 1,523 Chestnut st., President Strickland Kneass in the chair, 38 members present.

The annual reports of the secretary and treasurer were read, showing the club to be in good financial condition and an increase of membership of about 50 per cent. during the past year.

The retiring President, Mr. Strickland Kneass, gave a résumé of the progress of the engineering works under construction and that are in preparation, not only in our own country and Mexico but also in Europe and Asia, showing that Mexico is rapidly rising in the scale of nations by introducing internal improvements in the shape of extensive railroad lines and that the Chinese have at length been convinced that the barbarians have some ideas that may safely and advantageously be adopted for advancing the interests of the "flowery kingdom," and have therefore begun the construction of railroads and telegraphs.

In alluding to electricity and its use for illuminating, the number of inventors and the variety of lamps, both of the arc and incandescent systems, the deep interest the subject claims from the scientists of the day was shown. As a motor, electricity was also spoken of, when its earliest adaptation as a motive power was given to Jacobi and his little boat on the Neva in the year 1839.

Compressed air as a motor was also referred to and its practical use for street railways in France. Allusion was also made to the improvements in the manufacture of steel so as to obtain a reliable material as a substitute for iron by the Bessemer, Siemens and basic processes, and the effect made upon the extensive ore properties of our own State that are now being developed at large cost for washing machinery and connecting railroads.

A short notice of telegraphy was given, showing Morse as the first American who practically applied the magneto-electric telegraph. Underground telegraph lines, it was shown, were in general use in Germany, and were being introduced in France, the credit of which belongs to the Postmaster General of Germany.

The importance of the exhibition of grates and furnaces, constructed to consume smoke and gases that now escape without adding any value to the combustion, was favorably presented.

His comparison of the state of the art of to-day as compared with fifty years past as applied to steamships and railroads, and the faulty prophecies of scientists and business men as to what could not be done, shows the futility of measuring the future by our own limited knowledge of the present.

The tellers of election announced that the following gentlemen had been elected officers for the ensuing year: President, Rudolph Hering; Vice-President, Percival Roberts, Jr.; Secretary and Treasurer, Howard Murphy; Directors, Strickland Kneass, Frederic Graff, T. M. Cleemann, J. J. de Kinder and Wilfred Lewis.

On taking the chair for 1882 Mr. Rudolph Hering said:

I am deeply sensible of the distinction conferred by you in assigning me to a position which has been so worthily filled by my honored predecessors. My grateful acknowledgments are due to you all, and I can only hope that my earnest efforts in behalf of the welfare of our club will be a proof of the keen appreciation of the signal favor shown me this evening, for which I beg you to accept my heartfelt thanks.

The club has just completed the fourth year of its existence and, owing to the large number of its resident members, already occupies a prominent place among the kindred societies of our country. Its rapid growth has fully confirmed the desirability of a closer professional intercourse among Philadelphia engineers, a point which was placed before us in a strong light during the Centennial Exhibition, when it was not an uncommon occurrence that introductions even among ourselves were necessary when meeting at the headquarters of the American Society of Civil Engineers.

In my position, as a director of the Club for the past three years, I have endeavored, as far as it lay in my power, to promote its interests, and now I shall spare no efforts to still further increase its usefulness, in doing which I shall hope for your hearty support and co-operation.

HOWARD MURPHY,
Secretary and Treasurer.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 14.)

CLXXVI.—ATTICA, N. Y.

Attica, New York, in lat. 42° 55′ N., long. 78° 20′ W. is on Tonawanda Creek in a valley between ranges of hills running north and south and rising about 300 ft. above the creek.

The town was settled about the middle of the last century. Water-works were built in 1879 by M. S. Frost & Son as a private enterprise. The supply is taken from Crow Creek, a small stream running between steep hills of slate rock. A stone dam 11 ft. high, 4 ft. wide at top and 7 ft. at bottom forms a small impounding reservoir on the stream from which the water is conducted to the distribution. Cast-iron pipe are used for distribution; 4 miles are laid, of from 10-in. to 3-in. diameter, with 20 fire hydrants and 73 taps. The town pays $50 per year for each hydrant. Service pipes are of galvanized iron.

The population in 1880 was 1,935. The consumption is not given. The capital stock of the company is $60,000. No statements of cost, expenses or receipts are furnished. H. W. Frost is the Secretary and Treasurer, and M. S. Frost the President.

CLXXVII.—CANAJOHARIE.

Canajoharie, New York, in lat. 42° 56 N., long. 74° 33′ W., is on the south bank of the Mohawk River. Settled in 1800, and then called Roof's Village, it was incorporated as a village in 1829. Water-works were built in 1852 by a private corporation after the plans of J. W. Perkins. The supply is taken from springs issuing from a saturated gravel stratum, by two galleries or conduits, one 4 by 5 ft. and 90 ft. long, the other 2 by 4 ft. and 150 ft. long, and is distributed by gravity. The springs yield about 117,000 gallons per day. For fire purposes there is a reservoir 60 ft. square and 14 ft. deep, in excavation and embankment on a hill 135 ft. above the village and 92 ft. above the springs, to which water is pumped by a 4-in. pump driven by a 12-ft. overshot water wheel. The ordinary pressure in the mains is 18 lbs., and the fire pressure 50 lbs. per square inch.

Distribution is by cast-iron pipe of from 12 to 2-in. diameter, of which 2 miles are laid, with 11 fire hydrants and 100 taps. For the hydrants and two water-troughs the village pays $200 per annum. Lead pipe is used for service pipe. The population in 1880 was about 2,000, and the daily consumption 60,000 gallons.

The capital stock of the company is $10,000. The works have cost $12,500. There is a bonded debt of $2,500, bearing 5 and 6 per cent. interest. The expenses in 1880 were $140 and the receipts $1,008.

L. B. Clark is Secretary and Treasurer of the company and has been the Superintendent and General Manager since its organization.

CLXXVIII.—UNIVERSITY OF VIRGINIA.

The University of Virginia, in lat. 38° 2′ 3″ N., long. 78° 31′ 28″ W., near Charlottesville, is at the base of one of the spurs of the Blue Ridge and 2½ miles west of the Rivanna River. Toward the east the country is rolling and to the west mountainous.

The University was founded by Thomas Jefferson in 1825.

Water-works were built in 1858 after the plans of Charles Ellet, C. E. New works were built in 1868 after the plans of George Peyton, C. E.

The supply is taken from a reservoir in a ravine in the mountains, supplied partly by springs and partly by the surface drainage of about 50 acres. It is about 150 by 300 ft. surface dimensions, and is formed by a brick dam across the ravine, 20 ft. high and 100 ft. long at top. There are two walls laid in cement mortar and 6 in. apart, the intersecting space being filled with béton. The reservoir contains about 2,000,000 gallons and is 70 to 100 ft. above the University grounds. The outlet pipe is in a chamber inclosed by a double wall, with an intermediate space of 15 in. which is filled with charcoal. A 5-in. cast-iron pipe conveys the water 1 mile to the University, where it is distributed through 5,000 ft. of 3-in. pipe. There are 6 fire hydrants.

Before 1868, a No. 5 Worthington pump supplied the institution by pumping into tanks of 30,000 gallons capacity placed 60 ft. above the highest grounds. This pump and the tanks are still retained for use in emergencies.

The population supplied is about 600, and no record is kept of the quantity of water used.

The works have cost $28,132,20, and are in charge of the Superintendent of Grounds and Buildings. This position was held by William A. Pratt from 1858 to 1865, and by G. Peyton from 1868 to the present time.

CLXXIX.—BURLINGTON, N. J.

Burlington, New Jersey, in lat. 40° 9′ N., long. 74 53′ W., is on low, level ground on the east bank of the Delaware River. The town was founded in 1677.

In 1804 a private company built water-works, taking the supply from springs on high ground just south of the city, and conveying the water to the city and through High and East Broad streets in wooden pipes purchased from the city of Philadelphia, and which had been in use there for many years and were then being taken up and replaced by iron pipes. These pipes were of about 2-in. bore, and the supply was so limited that stringent regulations against the waste of water were enforced to the extent of fining a prominent citizen five dollars for giving water to a horse.

In 1843 Thomas Dugdale laid iron pipes through several streets and pumped into them from the river by a pump worked by a steam engine in a mill belonging to him. In consideration of the privilege of laying the pipes and furnishing water to consumers he supplied without charge 25 fire hydrants. In 1844 the mill was burned, and another engine erected by which the water was forced into seven iron tanks placed 50 ft. above the ground on a masonry foundation, which are still used.

In 1848 Mr. Dugdale purchased the property and franchises of the Aqueduct Company, and enlarged the reservoir or tank building, and erected an 8-horse power high-pressure engine and pump capable of raising 200,000 gallons per day.

In 1860 the works passed into the hands of a corporation styled the Burlington Water-Works Company, and in 1877 were purchased by the city for $25,000, and a Worthington compound duplex engine of 500,000 gallons capacity added. The water-tower was strengthened by building a masonry wall inside the old one, to which it fastened by iron clamps. The tanks, or reservoirs, hold 80,000 gallons. Distribution is by cast-iron pipe, of which 7 miles have been laid, of from 24 to 3-in. diameter, about 1½ miles being less than 6-in. There are, besides, 6 miles of old pipe laid by the company, and 2 miles of the wooden mains of the gravity system. The supply from the springs has greatly diminished, but is still used. A Birkinbine fire-protector enables a pressure of 65 lbs. per square inch, to be put on the mains for fire purposes. There are 87 fire hydrants and 1,038 taps. Lead service pipe is used.

The works constructed by the city were after the plans of Isaac S. Cassin, C. E.

The total cost to March 1, 1881, had been $64,600.66 and the receipts $35,000.

The bonded debt is $59,000, bearing 6 and 7 per cent. interest.

The population in 1880 was 7,855 and the daily consumption 143,011 gallons.

The expenses in 1880 for maintenance were $3,388.17 and the revenue $9,243.83.

The works are managed by five Water Commissioners appointed by the Common Council. Henry S. Haines is the Treasurer and Superintendent.

CLXXX.—WAUKEGAN.

Waukegan, Illinois, is in lat. 42° 30′ N. long. 88° W., on a bluff 80 ft. above and overlooking Lake Michigan. Settled in 1834, it was incorporated as a city in 1859. A water supply is procured from an artesian well, completed in 1875 to a depth of 1,134 ft. Rock is encountered 180 ft. from the surface, to which depth the boring is cased with a 4-in. iron pipe. The first pipe put in corroded and was replaced in 1881.

The water will rise to 65 ft. above the surface. The well discharges into a brick tank 20 ft. square and 20 ft. high, built half above and half below the surface of the ground, on the highest land in the city. The supply is copius and constant.

From the tank it is distributed by cast-iron pipe, of which 3 miles, mostly of 6-in. dameter, are laid, with 15 fire hydrants.

The population in 1880 was 4,031. The daily consumption is not stated. The yield of the well is in excess of the present demand. The cost of the well was $3,350. Revenue is not given. The works are owned by the city. J. F. Powell is the manager.

(TO BE CONTINUED.)

The receipt of statistics, as follows, is acknowledged with thanks: From A. H. Martine, Superintendent, Report of Fall River (Mass.) Water-works, Jan. 1, 1881; from H. S. Haines, Treasurer and Superintendent, statistics of Burlington (N. J.) Water-works, report for March, 1881, and water rates; fram H. W. Frost, Secretary and Treasurer, statistics of Attica (N. Y.) Water-works; from G. Peyton, Superintendent, statistics of Water-works of the University of Virginia, Charlottesville, Va.; from L. B. Clark, Superintendent, Secretary and Treasurer, statistics and water rates of the Canajoharie (N. Y.) Water-works Co.; from J. F. Powell, Manager, statistics of Waukegan (Ill.) Water-works; from J. Albert Mills, Superintendent, reports of Water-works Commission of St. Catharine's, Canada, for 1879 and 1880.

CORRESPONDENCE.

ON PROBABLE ERROR.

DETROIT, Mich., Jan. 13, 1882.

The usual method of finding the probable error of the mean of a series of observations is from the formula

$$0.6745\sqrt{\frac{SD^2}{n(n-1)}}$$

using Prof Merriman's method as given in your issue of Jan. 7. This, though undoubtedly the most accurate method, requires considerable time in computation. The following rule, founded on rigid principles, will be found to give the probable error close enough for all practical purposes, supposing of course that the observations have been properly made.

A glance at the observed results will show the greatest and least, and their difference will be the *range* in the results. Then for the probable error (r) of a single observation we have if the number of results is

		2	$r = \frac{1}{2}$ range.
		3	$r = \frac{1}{3}$ "
between	4 and	8	$r = \frac{1}{4}$ "
"	8 "	15	$r = \frac{1}{5}$ "
"	15 "	35	$r = \frac{1}{6}$ "
"	35 "	100	$r = \frac{1}{7}$ "

The probable error of the final result is found at once by dividing the probable error (r) of a single observation by the square root of the number of observations.

T. W. WRIGHT.

THE BEST STUMP PULLER.

MILWAUKEE, Wis., Jan. 3, 1882.

EDITOR ENGINEERING NEWS:

Replying to inquiry of your correspondent, Mr. L. J. Fisk, under date of Dec. 1, 1881, I will say that the Chamberlin stump pulling machine is the best one in use, according to my experience. The address is Chamberlin & Sons, Olean, N. Y.

Will you, or some of your readers, please inform me as to the best and most practical machine for sawing piles 10 to 12 feet under water, and oblige Yours truly, W. T. CASGRAIN.